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## 1 [Texture mapping 3D models of real-world scenes](#)

 Frederick M. Weinhaus, Venkat Devarajan  
December 1997 **ACM Computing Surveys (CSUR)**, Volume 29 Issue 4

Publisher: ACM Press

Full text available:  pdf(1.98 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#), [review](#)


Texture mapping has become a popular tool in the computer graphics industry in the last few years because it is an easy way to achieve a high degree of realism in computer-generated imagery with very little effort. Over the last decade, texture-mapping techniques have advanced to the point where it is possible to generate real-time perspective simulations of real-world areas by texture mapping every object surface with texture from photographic images of these real-world areas. The technique ...

**Keywords:** anti-aliasing, height field, homogeneous coordinates, image perspective transformation, image warping, multiresolution data, perspective projection, polygons, ray tracing, real-time scene generation, rectification, registration, texture mapping, visual simulators, voxels

## 2 [Prefiltered antialiased lines using half-plane distance functions](#)

 Robert McNamara, Joel McCormack, Norman P. Jouppi  
August 2000 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware HWWS '00**

Publisher: ACM Press


Full text available:  pdf(2.53 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We describe a method to compute high-quality antialiased lines by adding a modest amount of hardware to a fragment generator based upon half-plane edge functions. (A fragment contains the information needed to paint one pixel of a line or a polygon.) We surround an antialiased line with four edge functions to create a long, thin, rectangle. We scale the edge functions so that they compute signed distances from the four edges. At each fragment within the antialiased line, the four distances ...

**Keywords:** atialiasing, graphics accelerators, prefiltering

## 3 [The elements of nature: interactive and realistic techniques](#)

 Oliver Deussen, David S. Ebert, Ron Fedkiw, F. Kenton Musgrave, Przemyslaw Prusinkiewicz, Doug Roble, Jos Stam, Jerry Tessendorf  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

Publisher: ACM Press

Full text available:  pdf(17.65 MB)

Additional Information: [full citation](#), [abstract](#)

This updated course on simulating natural phenomena will cover the latest research and production techniques for simulating most of the elements of nature. The presenters will provide movie production, interactive simulation, and research perspectives on the difficult task of photorealistic modeling, rendering, and animation of natural phenomena. The course offers a nice balance of the latest interactive graphics

#### 4 Point-based computer graphics



Marc Alexa, Markus Gross, Mark Pauly, Hanspeter Pfister, Marc Stamminger, Matthias Zwicker  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

**Publisher:** ACM Press

Full text available: pdf(8.94 MB)

Additional Information: [full citation](#), [abstract](#), [citations](#)

This course introduces points as a powerful and versatile graphics primitive. Speakers present their latest concepts for the acquisition, representation, modeling, processing, and rendering of point sampled geometry along with applications and research directions. We describe algorithms and discuss current problems and limitations, covering important aspects of point based graphics.

#### 5 Exploiting perception in high-fidelity virtual environments: Exploiting perception in high-fidelity virtual environments



**Additional presentations from the 24th course are available on the citation page**

Mashhuda Glencross, Alan G. Chalmers, Ming C. Lin, Miguel A. Otaduy, Diego Gutierrez  
July 2006 **ACM SIGGRAPH 2006 Courses SIGGRAPH '06**

**Publisher:** ACM Press

Full text available: pdf(5.07 MB) mov  
(68:6 MIN)

Additional Information: [full citation](#), [abstract](#), [references](#)

The objective of this course is to provide an introduction to the issues that must be considered when building high-fidelity 3D engaging shared virtual environments. The principles of human perception guide important development of algorithms and techniques in collaboration, graphical, auditory, and haptic rendering. We aim to show how human perception is exploited to achieve realism in high fidelity environments within the constraints of available finite computational resources. In this course w ...

**Keywords:** collaborative environments, haptics, high-fidelity rendering, human-computer interaction, multi-user, networked applications, perception, virtual reality

#### 6 Separable image warping with spatial lookup tables



G. Wolberg, T. E. Boult

July 1989 **ACM SIGGRAPH Computer Graphics , Proceedings of the 16th annual conference on Computer graphics and interactive techniques SIGGRAPH '89**, Volume 23 Issue 3

**Publisher:** ACM Press

Full text available: pdf(1.99 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Image warping refers to the 2-D resampling of a source image onto a target image. In the general case, this requires costly 2-D filtering operations. Simplifications are possible when the warp can be expressed as a cascade of orthogonal 1-D transformations. In these cases, separable transformations have been introduced to realize large performance gains. The central ideas in this area were formulated in the 2-pass algorithm by Catmull and Smith. Although that method applies over an important cla ...

#### 7 Jagged edges: when is filtering needed?



Avi C. Naiman

October 1998 **ACM Transactions on Graphics (TOG)**, Volume 17 Issue 4

**Publisher:** ACM Press

Full text available: pdf(275.67 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Depiction of oblique edges by discrete pixels usually results in visible stair steps, often called jaggies. A variety of filtering approaches exists to minimize this visual artifact, but none has been applied selectively only to those edges that would otherwise appear jagged. A recent series of experiments has led to a model of the visibility of jagged edges. Here, we demonstrate how these data can be used efficiently to determine when filtering of edges is needed to elimin ...

**Keywords:** image quality, jagged edges, jaggies, visual sensitivity

#### 8 Real-time shading

Marc Olano, Kurt Akeley, John C. Hart, Wolfgang Heidrich, Michael McCool, Jason L. Mitchell, Randi Rost



**Publisher:** ACM Press

Full text available: [pdf\(7.39 MB\)](#)

Additional Information: [full citation](#), [abstract](#)

Real-time procedural shading was once seen as a distant dream. When the first version of this course was offered four years ago, real-time shading was possible, but only with one-of-a-kind hardware or by combining the effects of tens to hundreds of rendering passes. Today, almost every new computer comes with graphics hardware capable of interactively executing shaders of thousands to tens of thousands of instructions. This course has been redesigned to address today's real-time shading capabilities ...

## 9 Anti-aliasing in topological color spaces



Kenneth Turkowski

August 1986 **ACM SIGGRAPH Computer Graphics , Proceedings of the 13th annual conference on Computer graphics and interactive techniques SIGGRAPH '86**, Volume 20 Issue 4

**Publisher:** ACM Press

Full text available: [pdf\(5.19 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The power of a color space to perform well in interpolation problems such as anti-aliasing and smooth-shading is dependent on the topology of the color space as well as the number of elements it contains. We develop the *Major-minor* color space, which has a topology and representation that lends itself to simple anti-aliasing computations between elements of an arbitrary set of colors in an inexpensive frame store.

## 10 Antialiasing of interlaced video animation



John Amanatides, Don P. Mitchell

September 1990 **ACM SIGGRAPH Computer Graphics , Proceedings of the 17th annual conference on Computer graphics and interactive techniques SIGGRAPH '90**, Volume 24 Issue 4

**Publisher:** ACM Press

Full text available: [pdf\(7.19 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The production of computer-generated video presents a number of difficulties not encountered with motion pictures. Interlaced scanning and the color subcarrier of NTSC video are responsible for special problems such as interline flicker, and chroma aliasing. As in motion pictures, temporal aliasing is also an issue. A renderer can sample and filter a moving image in an arbitrary manner and is not constrained to simply imitate the behavior of a television camera. This paper explores several differences ...

## 11 Forward rasterization



Voicu Popescu, Paul Rosen

April 2006 **ACM Transactions on Graphics (TOG)**, Volume 25 Issue 2

**Publisher:** ACM Press

Full text available: [pdf\(1.04 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We describe forward rasterization, a class of rendering algorithms designed for small polygonal primitives. The primitive is efficiently rasterized by interpolation between its vertices. The interpolation factors are chosen to guarantee that each pixel covered by the primitive receives at least one sample which avoids holes. The location of the samples is recorded with subpixel accuracy using a pair of offsets which are then used to reconstruct/resample the output image. Offset reconstruction has ...

**Keywords:** 3D warping, antialiasing, point-based modeling and rendering, rasterization, rendering pipeline

## 12 Human vision, anti-aliasing, and the cheap 4000 line display



William J. Leier

July 1980 **ACM SIGGRAPH Computer Graphics , Proceedings of the 7th annual conference on Computer graphics and interactive techniques SIGGRAPH '80**, Volume 14 Issue 3

**Publisher:** ACM Press

Full text available: [pdf\(386.44 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


Despite its other advantages, one of the major objections to raster graphics has been the poor image quality and aliasing effects caused by discrete sampling. These effects include "jaggies" or stair-stepping, crawling, line breakup, and scintillation. Several solutions have been proposed in the literature, however, most suffer severe drawbacks and are only partially successful at eliminating aliasing effects. One solution, area anti-aliasing, is not only effective, it produces ...

**Keywords:** Anti-aliasing, Discrete sampling, Grey scale, Halftoning, Human vision, Raster graphics, Resolution, Visual perception

13 Quadrature prefiltering for high quality antialiasing

 Brian Guenter, Jack Tumblin  
October 1996 **ACM Transactions on Graphics (TOG)**, Volume 15 Issue 4

**Publisher:** ACM Press


Full text available:  pdf(2.09 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


This article introduces quadrature prefiltering, an accurate, efficient, and fairly simple algorithm for prefiltering polygons for scanline rendering. It renders very high quality images at reasonable cost, strongly suppressing aliasing artifacts. For equivalent RMS error, quadrature prefiltering is significantly faster than either uniform or jittered supersampling. Quadrature prefiltering is simple to implement and space-efficient; it needs only a small two-dimensional lookup table, even w ...

**Keywords:** antialiasing, prefiltering

14 Texture potential MIP mapping, a new high-quality texture antialiasing algorithm

 July 2000 **ACM Transactions on Graphics (TOG)**, Volume 19 Issue 3

**Publisher:** ACM Press

Full text available:  pdf(1.01 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)


A refined version of the texture potential mapping algorithm is introduced in which a one-dimensional MIP map is incorporated. This has the effect of controlling the maximum number of texture samples required. The new technique is compared to existing texture antialiasing methods in terms of quality and sample count. The new method is shown to compare favorably with existing techniques for producing high quality antialiased, texture-mapped images.

**Keywords:** anisotropic filtering, antialiasing, texture mapping

15 Three-dimensional medical imaging: algorithms and computer systems

 M. R. Stytz, G. Frieder, O. Frieder  
December 1991 **ACM Computing Surveys (CSUR)**, Volume 23 Issue 4


**Publisher:** ACM Press

Full text available:  pdf(7.38 MB)


Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)

**Keywords:** Computer graphics, medical imaging, surface rendering, three-dimensional imaging, volume rendering

16 Environment matting extensions: towards higher accuracy and real-time capture

 Yung-Yu Chuang, Douglas E. Zongker, Joel Hindorff, Brian Curless, David H. Salesin, Richard Szeliski  
July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques SIGGRAPH '00**

**Publisher:** ACM Press/Addison-Wesley Publishing Co.

Full text available:  pdf(1.48 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Environment matting is a generalization of traditional bluescreen matting. By photographing an object in front of a sequence of structured light backdrops, a set of approximate light-transport paths through the object can be computed. The original environment matting research chose a middle ground—using a moderate number of photographs to produce results that were reasonably accurate for many objects. In this work, we extend the technique in two opposite directions: recovering a more ...

**Keywords:** alpha channel, augmented reality, blue spill, blue-screen matting, clip art, colored transparency, environment map, environment matte, image-based rendering, real-time capture, reflection, refraction

## 17 Real-time volume graphics



Klaus Engel, Markus Hadwiger, Joe M. Kniss, Aaron E. Lefohn, Christof Rezk Salama, Daniel Weiskopf  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

**Publisher:** ACM Press

Full text available: pdf(7.63 MB)

Additional Information: [full citation](#), [abstract](#)

The tremendous evolution of programmable graphics hardware has made high-quality real-time volume graphics a reality. In addition to the traditional application of rendering volume data in scientific visualization, the interest in applying these techniques for real-time rendering of atmospheric phenomena and participating media such as fire, smoke, and clouds is growing rapidly. This course covers both applications in scientific visualization, e.g., medical volume data, and real-time rendering, ...

## 18 Techniques for conic splines



Vaughan Pratt

July 1985 **ACM SIGGRAPH Computer Graphics , Proceedings of the 12th annual conference on Computer graphics and interactive techniques SIGGRAPH '85**, Volume 19 Issue 3

**Publisher:** ACM Press

Full text available: pdf(1.07 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A number of techniques are presented for making conic splines more effective for 2D computer graphics. We give a brief account of the theory of conic splines oriented to computer graphics. We make Pitteway's algorithm exact, and repair an "aliasing" problem that has plagued the algorithm since its introduction in 1967. The curvature-matching problem for conics is solved by way of a simple formula for curvature at an endpoint which permits curvature to be matched exactly at non-inflection points ...

## 19 Terrain database interoperability issues in training with distributed interactive simulation



Guy A. Schiavone, S. Sureshchandran, Kenneth C. Hardis

July 1997 **ACM Transactions on Modeling and Computer Simulation (TOMACS)**, Volume 7 Issue 3

**Publisher:** ACM Press

Full text available: pdf(443.34 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

In Distributed Interactive Simulation (DIS), each participating node is responsible for maintaining its own model of the synthetic environment. Problems may arise if significant inconsistencies are allowed to exist between these separate world views, resulting in unrealistic simulation results or negative training, and a corresponding degradation of interoperability in a DIS simulation exercise. In the DIS community, this is known as the simulator terrain database (TDB) correlation problem. ...

**Keywords:** distributed interactive simulation, terrain databases

## 20 Session 5: Multiscale and multivariate visualizations of software evolution



Lucian Voinea, Alexandru Telea

September 2006 **Proceedings of the 2006 ACM symposium on Software visualization SoftVis '06**

**Publisher:** ACM Press

Full text available: pdf(930.13 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Software evolution visualization is a promising technique for assessing the software development process. We study how complex correlations of software evolution attributes can be made using multivariate visualization techniques. We use a combination of color and textures to depict up to four artifact attributes at the same time in one view using the same spatial layout. Next, we describe an interactive navigation method of the attribute space that can extend the correlation capabilities to four ...

**Keywords:** CVS, evolution visualization, software visualization

Terms used **line sampling**
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## 1 [Point-based computer graphics](#)


Marc Alexa, Markus Gross, Mark Pauly, Hanspeter Pfister, Marc Stamminger, Matthias Zwicker  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**
**Publisher:** ACM Press

Full text available:  pdf(8.94 MB)

Additional Information: [full citation](#), [abstract](#), [citations](#)

This course introduces points as a powerful and versatile graphics primitive. Speakers present their latest concepts for the acquisition, representation, modeling, processing, and rendering of point sampled geometry along with applications and research directions. We describe algorithms and discuss current problems and limitations, covering important aspects of point based graphics.

## 2 [The elements of nature: interactive and realistic techniques](#)


Oliver Deussen, David S. Ebert, Ron Fedkiw, F. Kenton Musgrave, Przemyslaw Prusinkiewicz, Doug Roble, Jos Stam, Jerry Tessendorf  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**
**Publisher:** ACM Press

Full text available:  pdf(17.65 MB)


Additional Information: [full citation](#), [abstract](#)

This updated course on simulating natural phenomena will cover the latest research and production techniques for simulating most of the elements of nature. The presenters will provide movie production, interactive simulation, and research perspectives on the difficult task of photorealistic modeling, rendering, and animation of natural phenomena. The course offers a nice balance of the latest interactive graphics hardware-based simulation techniques and the latest physics-based simulation techni ...

## 3 [Forward rasterization](#)


Voicu Popescu, Paul Rosen  
April 2006 **ACM Transactions on Graphics (TOG)**, Volume 25 Issue 2

**Publisher:** ACM Press

Full text available:  pdf(1.04 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We describe forward rasterization, a class of rendering algorithms designed for small polygonal primitives. The primitive is efficiently rasterized by interpolation between its vertices. The interpolation factors are chosen to guarantee that each pixel covered by the primitive receives at least one sample which avoids holes. The location of the samples is recorded with subpixel accuracy using a pair of offsets which are then used to reconstruct/resample the output image. Offset reconstruction ha ...

**Keywords:** 3D warping, antialiasing, point-based modeling and rendering, rasterization, rendering pipeline



## Antialiasing of interlaced video animation

John Amanatides, Don P. Mitchell

September 1990 **ACM SIGGRAPH Computer Graphics , Proceedings of the 17th annual conference on Computer graphics and interactive techniques SIGGRAPH '90**, Volume 24 Issue 4

**Publisher:** ACM Press

Full text available: pdf(7.19 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The production of computer-generated video presents a number of difficulties not encountered with motion pictures. Interlaced scanning and the color subcarrier of NTSC video are responsible for special problems such as interline flicker, and chroma aliasing. As in motion pictures, temporal aliasing is also an issue. A renderer can sample and filter a moving image in an arbitrary manner and is not constrained to simply imitate the behavior of a television camera. This paper explores several diffe ...



## 5 Texture potential MIP mapping, a new high-quality texture antialiasing algorithm

July 2000 **ACM Transactions on Graphics (TOG)**, Volume 19 Issue 3

**Publisher:** ACM Press

Full text available: pdf(1.01 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

A refined version of the texture potential mapping algorithm is introduced in which a one-dimensional MIP map is incorporated. This has the effect of controlling the maximum number of texture samples required. The new technique is compared to existing texture antialiasing methods in terms of quality and sample count. The new method is shown to compare favorably with existing techniques for producing high quality antialiased, texture-mapped images.

**Keywords:** anisotropic filtering, antialiasing, texture mapping



## 6 An alternative for Wang tiles: colored edges versus colored corners

Ares Lagae, Philip Dutré

October 2006 **ACM Transactions on Graphics (TOG)**, Volume 25 Issue 4

**Publisher:** ACM Press

Full text available: pdf(980.75 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

In this article we revisit the concept of Wang tiles and introduce corner tiles, square tiles with colored corners. During past years, Wang tiles have become a valuable tool in computer graphics. Important applications of Wang tiles include texture synthesis, tile-based texture mapping, and generating Poisson disk distributions. Through their colored edges, Wang tiles enforce continuity with their direct neighbors. However, Wang tiles do not directly constrain their diagonal neighbors. This lead ...

**Keywords:** Poisson disk distributions, Wang tiles, corner tiles, texture synthesis, tile-based texture mapping, tiling



## 7 Recreational computer graphics: Recreational computer graphics

Andrew Glassner

July 2006 **ACM SIGGRAPH 2006 Courses SIGGRAPH '06**

**Publisher:** ACM Press

Full text available: pdf(13.82 MB)

Additional Information: [full citation](#), [abstract](#)

Computer graphics isn't just a bunch of algorithms and programs: it's a gymnasium for the visual imagination, and a tool for investigating the world around us. Graphics can help us understand nature, invent new kinds of patterns and shapes, build up the clarity of our own mind's eye, and experiment with construction tools that would inspire even the most classical sculptors and painters. Going beyond tools and technique, this course invites attendees to think about using computer graphics in new ...



## 8 The lumigraph

Steven J. Gortler, Radek Grzeszczuk, Richard Szeliski, Michael F. Cohen  
August 1996





Publisher: ACM Press

Full text available: pdf(909.08 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

9 Spherical parametrization and remeshing



Emil Praun, Hugues Hoppe

July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

Publisher: ACM Press

Full text available: pdf(28.33 MB) mov(25:11 MIN) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

The traditional approach for parametrizing a surface involves cutting it into charts and mapping these piecewise onto a planar domain. We introduce a robust technique for directly parametrizing a genus-zero surface onto a spherical domain. A key ingredient for making such a parametrization practical is the minimization of a stretch-based measure, to reduce scale-distortion and thereby prevent undersampling. Our second contribution is a scheme for sampling the spherical domain using uniformly sub ...

**Keywords:** geometry images, meshes, remeshing, texture mapping

10 High performance imaging using large camera arrays



Bennett Wilburn, Neel Joshi, Vaibhav Vaish, Eino-Ville Talvala, Emilio Antunez, Adam Barth, Andrew Adams, Mark Horowitz, Marc Levoy

July 2005 **ACM Transactions on Graphics (TOG)**, **ACM SIGGRAPH 2005 Papers SIGGRAPH '05**, Volume 24 Issue 3

Publisher: ACM Press

Full text available: pdf(902.47 KB) mov(21:45 MIN) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The advent of inexpensive digital image sensors and the ability to create photographs that combine information from a number of sensed images are changing the way we think about photography. In this paper, we describe a unique array of 100 custom video cameras that we have built, and we summarize our experiences using this array in a range of imaging applications. Our goal was to explore the capabilities of a system that would be inexpensive to produce in the future. With this in mind, we used s ...

**Keywords:** camera arrays, spatiotemporal sampling, synthetic aperture

11 Synthetic aperture confocal imaging



Marc Levoy, Billy Chen, Vaibhav Vaish, Mark Horowitz, Ian McDowall, Mark Bolas

August 2004 **ACM Transactions on Graphics (TOG)**, **ACM SIGGRAPH 2004 Papers SIGGRAPH '04**, Volume 23 Issue 3

Publisher: ACM Press

Full text available: pdf(995.29 KB) mov(25:53 MIN) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Confocal microscopy is a family of imaging techniques that employ focused patterned illumination and synchronized imaging to create cross-sectional views of 3D biological specimens. In this paper, we adapt confocal imaging to large-scale scenes by replacing the optical apertures used in microscopy with arrays of real or virtual video projectors and cameras. Our prototype implementation uses a video projector, a camera, and an array of mirrors. Using this implementation, we explore confocal imagi ...

**Keywords:** Light fields, camera arrays, coded aperture, confocal microscopy, projector arrays, shaped illumination, synthetic aperture

12 A unified approach for hierarchical adaptive tessellation of surfaces



Luiz Velho, Luiz Henrique de Figueiredo, Jonas Gomes





**Publisher:** ACM Press

Full text available: pdf(1.08 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

This paper introduces a unified and general tessellation algorithm for parametric and implicit surfaces. The algorithm produces a hierarchical mesh that is adapted to the surface geometry and has a multiresolution and progressive structure. The representation can be exploited with advantages in several applications.

**Keywords:** adapted meshes, geometric modeling, implicit surfaces, multiresolution representations, parametric surfaces, polygonization, surface approximation

13 [A stroke-order free Chinese handwriting input system based on relative stroke positions and back-propagation networks](#)



Wing-nin Leung, Kam-shun Cheng

February 1996 **Proceedings of the 1996 ACM symposium on Applied Computing SAC '96**

**Publisher:** ACM Press

Full text available: pdf(585.50 KB)

Additional Information: [full citation](#), [references](#), [index terms](#)

**Keywords:** Chinese handwriting input method, applications, back-propagation network

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## 1 [Combining edges and points for interactive high-quality rendering](#)



Kavita Bala, Bruce Walter, Donald P. Greenberg

July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

Publisher: ACM Press

Full text available:  [pdf\(4.52 MB\)](#)  Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)  
[mov\(27:48 MIN\)](#)

This paper presents a new interactive rendering and display technique for complex scenes with expensive shading, such as global illumination. Our approach combines sparsely sampled shading (points) and analytically computed discontinuities (edges) to interactively generate high-quality images. The *edge-and-point* image is a new compact representation that combines edges and points such that fast, table-driven interpolation of pixel shading from nearby point samples is possible, while respo ...

**Keywords:** interactive software rendering, silhouette and shadow edges, sparse sampling and reconstruction

## 2 [Point-based computer graphics](#)



Marc Alexa, Markus Gross, Mark Pauly, Hanspeter Pfister, Marc Stamminger, Matthias Zwicker

August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

Publisher: ACM Press

Full text available:  [pdf\(8.94 MB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#)

This course introduces points as a powerful and versatile graphics primitive. Speakers present their latest concepts for the acquisition, representation, modeling, processing, and rendering of point sampled geometry along with applications and research directions. We describe algorithms and discuss current problems and limitations, covering important aspects of point based graphics.

## 3 [Progressive radiance evaluation using directional coherence maps](#)



Baining Guo

July 1998 **Proceedings of the 25th annual conference on Computer graphics and interactive techniques SIGGRAPH '98**

Publisher: ACM Press

Full text available:  [pdf\(8.97 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** directional coherence, image-space discontinuities, progressive refinement, radiance evaluation, rendering

#### 4 The accumulation buffer: hardware support for high-quality rendering



Paul Haeberli, Kurt Akeley

September 1990 **ACM SIGGRAPH Computer Graphics , Proceedings of the 17th annual conference on Computer graphics and interactive techniques SIGGRAPH '90**, Volume 24 Issue 4

**Publisher:** ACM Press

Full text available: [pdf\(3.46 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citings](#), [index terms](#)

This paper describes a system architecture that supports realtime generation of complex images, efficient generation of extremely high-quality images, and a smooth trade-off between the two. Based on the paradigm of integration, the architecture extends a state-of-the-art rendering system with an additional high-precision image buffer. This additional buffer, called the Accumulation Buffer, is used to integrate images that are rendered into the framebuffer. While originally conceived as a solutio ...

#### 5 Surface splatting



Matthias Zwicker, Hanspeter Pfister, Jeroen van Baar, Markus Gross

August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques SIGGRAPH '01**

**Publisher:** ACM Press

Full text available: [pdf\(5.27 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citings](#), [index terms](#)

Modern laser range and optical scanners need rendering techniques that can handle millions of points with high resolution textures. This paper describes a point rendering and texture filtering technique called *surface splatting* which directly renders opaque and transparent surfaces from point clouds without connectivity. It is based on a novel screen space formulation of the Elliptical Weighted Average (EWA) filter. Our rigorous mathematical analysis extends the texture resampling fram ...

**Keywords:** antialiasing, frame buffer algorithms, image-based rendering, rendering systems, texture mapping

#### 6 The elements of nature: interactive and realistic techniques



Oliver Deussen, David S. Ebert, Ron Fedkiw, F. Kenton Musgrave, Przemyslaw Prusinkiewicz, Doug Roble, Jos Stam, Jerry Tessendorf

August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

**Publisher:** ACM Press

Full text available: [pdf\(17.65 MB\)](#) Additional Information: [full citation](#), [abstract](#)

This updated course on simulating natural phenomena will cover the latest research and production techniques for simulating most of the elements of nature. The presenters will provide movie production, interactive simulation, and research perspectives on the difficult task of photorealistic modeling, rendering, and animation of natural phenomena. The course offers a nice balance of the latest interactive graphics hardware-based simulation techniques and the latest physics-based simulation techni ...

#### 7 Soft shadow volumes for ray tracing



Samuli Laine, Timo Aila, Ulf Assarsson, Jaakko Lehtinen, Tomas Akenine-Möller

July 2005 **ACM Transactions on Graphics (TOG) , ACM SIGGRAPH 2005 Papers SIGGRAPH '05**, Volume 24 Issue 3

**Publisher:** ACM Press

Full text available: [pdf\(1.30 MB\)](#) [mov\(24:0 MIN\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citings](#), [index terms](#)

We present a new, fast algorithm for rendering physically-based soft shadows in ray tracing-based renderers. Our method replaces the hundreds of shadow rays commonly used in stochastic ray tracers with a single shadow ray and a local reconstruction of the visibility function. Compared to tracing the shadow rays, our algorithm produces exactly the same image while executing one to two orders of magnitude faster in the test scenes used. Our first contribution is a two-stage method for quickly dete ...

**Keywords:** shadow algorithms, visibility determination

8 Hardware: Fine tone control in hardware hatching



Matthew Webb, Emil Praun, Adam Finkelstein, Hugues Hoppe

June 2002 **Proceedings of the 2nd international symposium on Non-photorealistic animation and rendering NPAR '02**

**Publisher:** ACM Press

Full text available: pdf(11.35 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citings](#), [index terms](#)

Recent advances in NPR have enabled real-time rendering of 3D models shaded with hatching strokes for use in interactive applications. The key challenges in real-time hatching are to convey tone by dynamically adjusting stroke density, while controlling stroke size and maintaining frame-to-frame coherence. In this paper, we introduce two new real-time hatching schemes that leverage recent advances in texture mapping hardware. Both schemes provide enhanced control of tone, thereby avoiding blendi ...

**Keywords:** line art, multitexturing, non-photorealistic rendering

9 Compressed multisampling for efficient hardware edge antialiasing

Philippe Beaudoin, Pierre Poulin

May 2004 **Proceedings of the 2004 conference on Graphics interface GI '04**

**Publisher:** Canadian Human-Computer Communications Society

Full text available: pdf(478.49 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

Today's hardware graphics accelerators incorporate techniques to antialias edges and minimize geometry-related sampling artifacts. Two such techniques, brute force supersampling and multisampling, increase the sampling rate by rasterizing the triangles in a larger antialiasing buffer that is then filtered down to the size of the framebuffer. The sampling rate is proportional to the number of subsamples in the antialiasing buffer and, when no compression is used, to the memory it occupies. In tur ...

**Keywords:** edge antialiasing, graphics hardware, multisampling

10 Gaze-directed volume rendering



Marc Levoy, Ross Whitaker

February 1990 **ACM SIGGRAPH Computer Graphics , Proceedings of the 1990 symposium on Interactive 3D graphics SI3D '90**, Volume 24 Issue 2

**Publisher:** ACM Press

Full text available: pdf(712.64 KB) Additional Information: [full citation](#), [abstract](#), [citings](#), [index terms](#)

We direct our gaze at an object by rotating our eyes or head until the object's projection falls on the fovea, a small region of enhanced spatial acuity near the center of the retina. In this paper, we explore methods for incorporating gaze direction into rendering algorithms. This approach permits generation of images exhibiting continuously varying resolution, and allows these images to be displayed on conventional television monitors. Specifically, we describe a ray tracer for volume data in ...

11 Antialiasing through stochastic sampling



Mark A. Z. Dippé, Erling Henry Wold

July 1985 **ACM SIGGRAPH Computer Graphics , Proceedings of the 12th annual conference on Computer graphics and interactive techniques SIGGRAPH '85**, Volume 19 Issue 3

**Publisher:** ACM Press

Full text available: pdf(4.06 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citings](#), [index terms](#)

*Stochastic sampling techniques*, in particular *Poisson* and *fittered* sampling, are developed and analyzed. These approaches allow the construction of *alias-free* approximations to continuous functions using discrete calculations. Stochastic sampling scatters high

frequency information into broadband *noise* rather than generating the false *pattern* produced by *regular* sampling. The type of randomness used in the sampling process controls the spectral c ...

**Keywords:** adaptive, aliasing, antialiasing, filtering, noise, ray tracing, stochastic sampling

## 12 Light field rendering



Marc Levoy, Pat Hanrahan

August 1996 **Proceedings of the 23rd annual conference on Computer graphics and interactive techniques SIGGRAPH '96**

**Publisher:** ACM Press

Full text available: [pdf\(376.59 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** epipolar analysis, holographic stereogram, image-based rendering, light field, vector quantization

## 13 Computing the discrepancy with applications to supersampling patterns



David P. Dobkin, David Eppstein, Don P. Mitchell

October 1996 **ACM Transactions on Graphics (TOG)**, Volume 15 Issue 4

**Publisher:** ACM Press

Full text available: [pdf\(495.97 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Patterns used for supersampling in graphics have been analyzed from statistical and signal-processing viewpoints. We present an analysis based on a type of isotropic discrepancy—how good patterns are at estimating the area in a region of defined type. We present algorithms for computing discrepancy relative to regions that are defined by rectangles, halfplanes, and higher-dimensional figures. Experimental evidence shows that popular supersampling patterns have discrepancies with better ...

**Keywords:** discrepancy, supersampling

## 14 Antialiased ray tracing by adaptive progressive refinement



J. Painter, K. Sloan

July 1989 **ACM SIGGRAPH Computer Graphics , Proceedings of the 16th annual conference on Computer graphics and interactive techniques SIGGRAPH '89**, Volume 23 Issue 3

**Publisher:** ACM Press

Full text available: [pdf\(1.29 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We describe an antialiasing system for ray tracing based on adaptive progressive refinement. The goals of the system are to produce high quality antialiased images at a modest average sample rate, and to refine the image progressively so that the image is available in a usable form early and is refined gradually toward the final result. The method proceeds by adaptive stochastic sampling of the image plane, evaluation of the samples by ray tracing, and image reconstruction from the samples. Adapt ...

## 15 Forward rasterization



Voicu Popescu, Paul Rosen

April 2006 **ACM Transactions on Graphics (TOG)**, Volume 25 Issue 2

**Publisher:** ACM Press

Full text available: [pdf\(1.04 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We describe forward rasterization, a class of rendering algorithms designed for small polygonal primitives. The primitive is efficiently rasterized by interpolation between its vertices. The interpolation factors are chosen to guarantee that each pixel covered by the


primitive receives at least one sample which avoids holes. The location of the samples is recorded with subpixel accuracy using a pair of offsets which are then used to reconstruct/resample the output image. Offset reconstruction ha ...

**Keywords:** 3D warping, antialiasing, point-based modeling and rendering, rasterization, rendering pipeline

16 Texture potential MIP mapping, a new high-quality texture antialiasing algorithm

 July 2000 **ACM Transactions on Graphics (TOG)**, Volume 19 Issue 3


**Publisher:** ACM Press

Full text available:  [pdf\(1.01 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

A refined version of the texture potential mapping algorithm is introduced in which a one-dimensional MIP map is incorporated. This has the effect of controlling the maximum number of texture samples required. The new technique is compared to existing texture antialiasing methods in terms of quality and sample count. The new method is shown to compare favorably with existing techniques for producing high quality antialiased, texture-mapped images.

**Keywords:** anisotropic filtering, antialiasing, texture mapping

17 State of the art in Monte Carlo global illumination

 Philip Dutré, Henrik Wann Jensen, Jim Arvo, Kavita Bala, Philippe Bekaert, Steve Marschner, Matt Pharr


August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

**Publisher:** ACM Press

Full text available:  [pdf\(5.48 MB\)](#) Additional Information: [full citation](#), [abstract](#)


Realistic image synthesis is increasingly important in areas such as entertainment (movies, special effects and games), design, architecture and more. A common trend in all these areas is the quest for more realistic images of increasingly complex models. Monte Carlo global illumination algorithms are the only methods that can handle this complexity. Recent advances in algorithms and compute power has made Monte Carlo algorithms very practical and a natural choice for most problems. The purpose o ...

18 Efficient image-based methods for rendering soft shadows

 Maneesh Agrawala, Ravi Ramamoorthi, Alan Heirich, Laurent Moll

July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques SIGGRAPH '00**

**Publisher:** ACM Press/Addison-Wesley Publishing Co.

Full text available:  [pdf\(11.36 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present two efficient imaged-based approaches for computation and display of high-quality soft shadows from area light sources. Our methods are related to shadow maps and provide the associated benefits. The computation time and memory requirements for adding soft shadows to an image depend on image size and the number of lights, not geometric scene complexity. We also show that because area light sources are localized in space, soft shadow computations are particularly well suited to im ...


**Keywords:** image-based rendering, raytracing, shadows

19 A Framework for Sample-Based Rendering with O-Buffers

Huamin Qu, Arie Kaufman, Ran Shao, Ankush Kumar

October 2003 **Proceedings of the 14th IEEE Visualization 2003 (VIS'03) VIS '03**

**Publisher:** IEEE Computer Society

Full text available:  [pdf\(281.77 KB\)](#) Additional Information: [full citation](#), [abstract](#)

We present an innovative modeling and rendering primitive, called the O-buffer, for

sample-based graphics, such as images, volumes, and points. The 2D or 3D O-buffer is in essence a conventional image or a volume, respectively, except that samples are not restricted to a regular grid. A sample position in the O-buffer is recorded as an offset to the nearest grid point of a regular base grid (hence the name O-buffer). The offset is typically quantized for compact representation and efficient render ...

**Keywords:** Sample-based rendering, image-based rendering, hybrid rendering, irregular sampling, hierarchy, offset, frame buffer, layered depth image

## 20 Decorating implicit surfaces



Hans Køhling Pedersen

September 1995

**Proceedings of the 22nd annual conference on Computer graphics and interactive techniques SIGGRAPH '95**

**Publisher:** ACM Press

Full text available: pdf(421.73 KB)

ps(1.39 MB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)



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## 1 [Texture mapping 3D models of real-world scenes](#)



Frederick M. Weinhaus, Venkat Devarajan

December 1997 **ACM Computing Surveys (CSUR)**, Volume 29 Issue 4

Publisher: ACM Press

Full text available:  [pdf\(1.98 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#), [review](#)

Texture mapping has become a popular tool in the computer graphics industry in the last few years because it is an easy way to achieve a high degree of realism in computer-generated imagery with very little effort. Over the last decade, texture-mapping techniques have advanced to the point where it is possible to generate real-time perspective simulations of real-world areas by texture mapping every object surface with texture from photographic images of these real-world areas. The technique ...

**Keywords:** anti-aliasing, height field, homogeneous coordinates, image perspective transformation, image warping, multiresolution data, perspective projection, polygons, ray tracing, real-time scene generation, rectification, registration, texture mapping, visual simulators, voxels


## 2 [Prefiltered antialiased lines using half-plane distance functions](#)



Robert McNamara, Joel McCormack, Norman P. Jouppi

August 2000 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware HWWS '00**

Publisher: ACM Press

Full text available:  [pdf\(2.53 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We describe a method to compute high-quality antialiased lines by adding a modest amount of hardware to a fragment generator based upon half-plane edge functions. (A fragment contains the information needed to paint one pixel of a line or a polygon.) We surround an antialiased line with four edge functions to create a long, thin, rectangle. We scale the edge functions so that they compute signed distances from the four edges. At each fragment within the antialiased line, the four distances ...

**Keywords:** atialiasing, graphics accelerators, prefiltering

## 3 [An efficient antialiasing technique](#)



Xiaolin Wu

July 1991 **ACM SIGGRAPH Computer Graphics , Proceedings of the 18th annual conference on Computer graphics and interactive techniques SIGGRAPH '91**, Volume 25 Issue 4

Publisher: ACM Press



An intuitive concept of antialiasing is developed into very efficient antialiased line and circle generators that require even less amount of integer arithmetic than Bresenham's line and circle algorithms. Unlike its predecessors, the new antialiasing technique is derived in spatial domain (raster plane) under a subjectively meaningful error measure to preserve the dynamics of curve and object boundaries. A formal analysis of the new antialiasing technique in frequency domain is also conducted. ...

**Keywords:** antialiasing, convolution, curve digitization, digital geometry




#### 4 [High speed high quality antialiased vector generation](#)



Anthony C. Barkans

September 1990 **ACM SIGGRAPH Computer Graphics , Proceedings of the 17th annual conference on Computer graphics and interactive techniques SIGGRAPH '90**, Volume 24 Issue 4

**Publisher:** ACM Press

Full text available:  [pdf\(2.87 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A vector generation method is described in which a high quality image rendering scheme is coupled with a high speed scan-conversion algorithm. The rendering scheme consists of two parts. First a prefiltering method is used to antialias the vectors. Second a compositing technique is used to compose the vectors into the frame-buffer. The scan-conversion algorithm presented allows a single vector to be scan-converted by either by a single processor or a set of processors running in parallel. When u ...





#### 5 [Combining edges and points for interactive high-quality rendering](#)



Kavita Bala, Bruce Walter, Donald P. Greenberg

July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

**Publisher:** ACM Press

Full text available:  [pdf\(4.52 MB\)](#)  [mov\(27:48 MIN\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents a new interactive rendering and display technique for complex scenes with expensive shading, such as global illumination. Our approach combines sparsely sampled shading (points) and analytically computed discontinuities (edges) to interactively generate high-quality images. The *edge-and-point* image is a new compact representation that combines edges and points such that fast, table-driven interpolation of pixel shading from nearby point samples is possible, while respo ...

**Keywords:** interactive software rendering, silhouette and shadow edges, sparse sampling and reconstruction




#### 6 [Anti-aliased line drawing using brush extrusion](#)



Turner Whitted

July 1983 **ACM SIGGRAPH Computer Graphics , Proceedings of the 10th annual conference on Computer graphics and interactive techniques SIGGRAPH '83**, Volume 17 Issue 3

**Publisher:** ACM Press

Full text available:  [pdf\(752.77 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


This algorithm draws lines on a gray-scale raster display by dragging a "brush" along the path of the line. The style of the line is determined by the properties of the brush. An anti-aliasing calculation is performed once for the brush itself and thereafter only a trivial additional operation is needed for each pixel through which the brush is dragged to yield an anti-aliased line. There are few constraints on the size, shape, and attributes of the brush. Lines can b ...

**Keywords:** Anti-aliasing, Filtering, Line drawing, Painting, Raster display

7 Point-based computer graphics

 Marc Alexa, Markus Gross, Mark Pauly, Hanspeter Pfister, Marc Stamminger, Matthias Zwicker  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

**Publisher:** ACM Press


Full text available:  pdf(8.94 MB) Additional Information: [full citation](#), [abstract](#), [citations](#)

This course introduces points as a powerful and versatile graphics primitive. Speakers present their latest concepts for the acquisition, representation, modeling, processing, and rendering of point sampled geometry along with applications and research directions. We describe algorithms and discuss current problems and limitations, covering important aspects of point based graphics.

8 Progressive radiance evaluation using directional coherence maps


 Baining Guo  
July 1998 **Proceedings of the 25th annual conference on Computer graphics and interactive techniques SIGGRAPH '98**

**Publisher:** ACM Press


Full text available:  pdf(8.97 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** directional coherence, image-space discontinuities, progressive refinement, radiance evaluation, rendering

9 The elements of nature: interactive and realistic techniques

 Oliver Deussen, David S. Ebert, Ron Fedkiw, F. Kenton Musgrave, Przemyslaw Prusinkiewicz, Doug Roble, Jos Stam, Jerry Tessendorf  
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

**Publisher:** ACM Press


Full text available:  pdf(17.65 MB) Additional Information: [full citation](#), [abstract](#)

This updated course on simulating natural phenomena will cover the latest research and production techniques for simulating most of the elements of nature. The presenters will provide movie production, interactive simulation, and research perspectives on the difficult task of photorealistic modeling, rendering, and animation of natural phenomena. The course offers a nice balance of the latest interactive graphics hardware-based simulation techniques and the latest physics-based simulation techni ...


10 Talisman: commodity realtime 3D graphics for the PC

 Jay Torborg, James T. Kajiya  
August 1996 **Proceedings of the 23rd annual conference on Computer graphics and interactive techniques SIGGRAPH '96**


**Publisher:** ACM Press

Full text available:  pdf(107.48 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

11 The accumulation buffer: hardware support for high-quality rendering

 Paul Haeberli, Kurt Akeley  
September 1990 **ACM SIGGRAPH Computer Graphics , Proceedings of the 17th annual conference on Computer graphics and interactive techniques SIGGRAPH '90**, Volume 24 Issue 4

**Publisher:** ACM Press

Full text available:  pdf(3.46 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper describes a system architecture that supports realtime generation of complex images, efficient generation of extremely high-quality images, and a smooth trade-off between the two. Based on the paradigm of integration, the architecture extends a state-of-the-art rendering system with an additional high-precision image buffer. This additional

buffer, called the Accumulation Buffer, is used to integrate images that are rendered into the framebuffer. While originally conceived as a solution ...

## 12 Jagged edges: when is filtering needed?



Avi C. Naiman

October 1998 **ACM Transactions on Graphics (TOG)**, Volume 17 Issue 4

Publisher: ACM Press

Full text available: pdf(275.67 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Depiction of oblique edges by discrete pixels usually results in visible stair steps, often called jaggies. A variety of filtering approaches exists to minimize this visual artifact, but none has been applied selectively only to those edges that would otherwise appear jagged. A recent series of experiments has led to a model of the visibility of jagged edges. Here, we demonstrate how these data can be used efficiently to determine when filtering of edges is needed to eliminate ...

**Keywords:** image quality, jagged edges, jaggies, visual sensitivity

## 13 Exploiting perception in high-fidelity virtual environments: Exploiting perception in high-fidelity virtual environments



**Additional presentations from the 24th course are available on the citation page**

Mashhuda Glencross, Alan G. Chalmers, Ming C. Lin, Miguel A. Otaduy, Diego Gutierrez  
July 2006 **ACM SIGGRAPH 2006 Courses SIGGRAPH '06**

Publisher: ACM Press

Full text available: pdf(5.07 MB) mov(68:6 MIN)

Additional Information: [full citation](#), [abstract](#), [references](#)

The objective of this course is to provide an introduction to the issues that must be considered when building high-fidelity 3D engaging shared virtual environments. The principles of human perception guide important development of algorithms and techniques in collaboration, graphical, auditory, and haptic rendering. We aim to show how human perception is exploited to achieve realism in high fidelity environments within the constraints of available finite computational resources. In this course we ...

**Keywords:** collaborative environments, haptics, high-fidelity rendering, human-computer interaction, multi-user, networked applications, perception, virtual reality

## 14 Surface splatting



Matthias Zwicker, Hanspeter Pfister, Jeroen van Baar, Markus Gross

August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques SIGGRAPH '01**

Publisher: ACM Press

Full text available: pdf(5.27 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Modern laser range and optical scanners need rendering techniques that can handle millions of points with high resolution textures. This paper describes a point rendering and texture filtering technique called *surface splatting* which directly renders opaque and transparent surfaces from point clouds without connectivity. It is based on a novel screen space formulation of the Elliptical Weighted Average (EWA) filter. Our rigorous mathematical analysis extends the texture resampling framework ...

**Keywords:** antialiasing, frame buffer algorithms, image-based rendering, rendering systems, texture mapping

## 15 Plenoptic sampling



Jin-Xiang Chai, Shing-Chow Chan, Heung-Yeung Shum, Xin Tong

July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques SIGGRAPH '00**

This paper studies the problem of plenoptic sampling in image-based rendering (IBR). From a spectral analysis of light field signals and using the sampling theorem, we mathematically derive the analytical functions to determine the minimum sampling rate for light field rendering. The spectral support of a light field signal is bounded by the minimum and maximum depths only, no matter how complicated the spectral support might be because of depth variations in the scene. The minimum sampling ...

**Keywords:** image-based rendering, plenoptic functions, plenoptic sampling, sampling, spectral analysis


16 [An updated cross-indexed guide to the ray-tracing literature](#)



L. Richard Speer

January 1992 **ACM SIGGRAPH Computer Graphics**, Volume 26 Issue 1

**Publisher:** ACM Press

Full text available:  [pdf\(2.94 MB\)](#)

Additional Information: [full citation](#), [index terms](#)

17 [GPU rendering: Cycle shading for the assessment and visualization of shape in one and two codimensions](#)



Daniel Weiskopf, Helwig Hauser

June 2006 **Proceedings of the 2006 conference on Graphics interface GI '06**

**Publisher:** Canadian Information Processing Society

Full text available:  [pdf\(731.37 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

In this paper we propose cycle shading and hatched cycle shading as new local shading techniques for shape assessment and visualization. Natural surface highlights are extended to not only appear in isolated parts of a surface, but to reappear throughout the surface in a regular and easy-to-control pattern. Thereby even small surface variations become visible, wherever they are located on the surface. We further extend (hatched) cycle shading to curves in 3D, i.e., to shapes of higher codimensio ...

**Keywords:** GPU methods, curve rendering, non-photorealistic rendering, shape visualization, surface assessment, vector field visualization


18 [Dissertation Abstracts in Computer Graphics](#)



Jeffrey J. McConnell

April 1988 **ACM SIGGRAPH Computer Graphics**, Volume 22 Issue 2

**Publisher:** ACM Press

Full text available:  [pdf\(1.65 MB\)](#)

Additional Information: [full citation](#), [abstract](#)


This paper is the first of a yearly compendium of abstracts from masters and doctoral theses in computer graphics. The compendium is being provided as a guide to the work being done in computer graphics by graduate students. Any requests for further information about a thesis or graduate student should be directed to the institution involved. This year's compendium has 54 entries from 23 institutions. The list is by no means complete as there are several prominent graduate schools missing. It is ...

19 [Dissertation Abstracts in Computer Graphics](#)



January 1992 **ACM SIGGRAPH Computer Graphics**, Volume 26 Issue 1

**Publisher:** ACM Press

Full text available:  [pdf\(2.53 MB\)](#)

Additional Information: [full citation](#)

20

[The triangle processor and normal vector shader: a VLSI system for high performance](#)






graphics

Michael Deering, Stephanie Winner, Bic Schediwy, Chris Duffy, Neil Hunt

June 1988 **ACM SIGGRAPH Computer Graphics , Proceedings of the 15th annual conference on Computer graphics and interactive techniques SIGGRAPH '88**,  
Volume 22 Issue 4

Publisher: ACM Press

Full text available:  [pdf\(2.29 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Current affordable architectures for high-speed display of shaded 3D objects operate orders of magnitude too slowly. Recent advances in floating point chip technology have outpaced polygon fill time, making the memory access bottleneck between the drawing processor and the frame buffer the most significant factor to be accelerated. Massively parallel VLSI systems have the potential to bypass this bottleneck, but to date only at very high cost. We describe a new more affordable VLSI solution. A pi ...

**Keywords:** graphics VLSI, hardware lighting models, interpolation, real-time image display, shading, triangle processor

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IEEE CNF IEEE Conference Proceeding

IEE CNF IEE Conference Proceeding

IEEE STD IEEE Standard

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IEE JNL IEE Journal or Magazine

IEEE CNF IEEE Conference Proceeding

IEE CNF IEE Conference Proceeding

IEEE STD IEEE Standard

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IEE JNL IEE Journal or Magazine  
IEEE CNF IEEE Conference Proceeding  
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**Applicant, Title of invention, Abstract** --- e.g. computer semiconductor

If you use the AND/OR operation, please leave a SPACE between keywords.

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line sampling pattern

AND

AND

horizontal vertical diagonal orientation major

OR

AND

antialias antialiased antialiasing anti-alias anti-aliasing anti-aliased

OR

AND

**Date of publication of application** --- e.g. 19980401 - 19980405

AND

**IPC** --- e.g. D01B7/04 A01C11/02

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line pattern

AND

AND

horizontal vertical diagonal orientation major

OR

AND

antialias antialiased antialiasing anti-alias anti-aliasing anti-aliased

OR

AND

**Date of publication of application** --- e.g. 19980401 - 19980405

AND

**IPC** --- e.g. D01B7/04 A01C11/02

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**Applicant, Title of invention, Abstract** --- e.g. computer semiconductor

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line subpixel

AND

AND

horizontal vertical diagonal orientation major

OR

AND

antialias antialiased antialiasing anti-alias anti-aliasing anti-aliased

OR

AND

**Date of publication of application** --- e.g. 19980401 - 19980405

-

AND

**IPC** --- e.g. D01B7/04 A01C11/02

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Approximately **458** results found in the Worldwide database for:  
**line AND sampling AND pattern** in the title or abstract  
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- Data supplied from the *esp@cenet* database - Worldwide

## RESULT LIST

5 results found in the Worldwide database for:

**line and sampling and pattern and orientation** in the title or abstract

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### 1 High quality antialiased lines with dual sampling pattern

Inventor: O'DRISCOLL GERARD (GB)

Applicant: 3DLABS INC LTD (US)

EC: G06T11/20L

IPC: **G06T11/20; G06T11/20**; (IPC1-7): G09G5/00

Publication info: **US2003164840** - 2003-09-04

### 2 System for printed circuit board defect detection

Inventor: MACFARLANE JAMES W (US); SMYTH BRUCE E (US)

Applicant: ITEK CORP (US)

EC: G06T7/00B

IPC: **G06T7/00; G06T7/00**; (IPC1-7): G06K9/00

Publication info: **US4578810** - 1986-03-25

### 3 Printed circuit board defect detection of detecting maximum line width violations

Inventor: SMYTH BRUCE E (US)

Applicant: ITEK CORP (US)

EC: G01B11/02C; G06T7/00B

IPC: **G01B11/02; G06T7/00; G01B11/02** (+2)

Publication info: **US4500202** - 1985-02-19

### 4 PRINTED CODE SCANNING SYSTEM

Inventor: BERLER R

Applicant: PITNEY BOWES ALPEX

EC: G06K7/10E1

IPC: **G06K7/10; G06K7/10**; (IPC1-7): G06K7/10 (+1)

Publication info: **US3774014** - 1973-11-20

### 5 No title available

Inventor:

Applicant:

EC: G06K9/00A2

IPC: **G06K9/00; G06K9/00**; (IPC1-7): G06K9/12

Publication info: **GB1225083** - 1971-03-17

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